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A sub-GeV dark matter model

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We propose an extension of the Standard Model gauge symmetry by the gauge group U(1)_T3R in order to address the Yukawa coupling hierarchy between the third generation fermions and the first two generation fermions of the SM. We assume that only the right-handed fermions of the first two generations are charged under the U(1)_T3R. In addition to the new dark gauge boson, we have a dark scalar particle whose vacuum expectation value breaks the U(1)_T3R symmetry down to Z_2 symmetry and also explain the hierarchy problem. A vev of O(GeV) is required to explain the mass parameters of the light flavor sectors. The dark matter particle arising from the model naturally has mass in the O(1-100) MeV range. The model satisfies all the current constraints. We discuss the various prospects of the Direct detection of the dark matter. The dark sector contains a Dirac fermion which gives two Majorana physical fields, one or both of which are dark matter. They have diagonal interactions with the dark scalar and off-diagonal interactions with the dark boson. Thus we get both elastic and inelastic Spin Independent DM-nucleon scattering mediated via the dark scalar and the dark gauge boson respectively. The model gives correct thermal relic density by annihilation via the dark scalar or dark gauge boson resonances.

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